

CLAIMS

1. Deforming apparatus for forming a curve in a deformable material member, the apparatus comprising:

- a first member comprising a first member body and a first deforming portion, the first deforming portion extending in a first direction and having a first deforming end and a second deforming end; and

- a second member comprising a second member body and a second deforming portion; wherein

- the first and second members are arranged to receive a deformable material member between them in a second direction, transverse to the first direction;

- the first and second members are movable relatively towards each other to a first relative position to deform the deformable material member, in the first direction, with the first and second deforming portions;

- the first and second members are movable relatively away from each other to a second relative position; and

- when the first and second members are in the first relative position, the first deforming end of the first deforming portion is closer to the second deforming portion than the second deforming end of the first deforming portion is to the second deforming portion.

2. Deforming apparatus according to claim 1, wherein

- the second deforming portion has a first opposing portion for opposing the first deforming end of the first deforming portion and a second opposing portion for opposing the second deforming end of the first deforming portion; and

- when the first and second members are in the first relative position, the first deforming end of the first deforming portion is closer to the first opposing portion of the second deforming portion than the second deforming end of the first deforming portion is to the second opposing portion of the second deforming portion.

3. Deforming apparatus according to claim 1, wherein

the first deforming portion has a first deforming surface for contacting the deformable material member and the second deforming portion has a second deforming surface for contacting the deformable material member; and

the first and second deforming surfaces are not complementary to each other.

4. Deforming apparatus according to claim 43, wherein the first and second deforming surfaces are tapered relative to each other.
5. Deforming apparatus according to claim 3, wherein the first and second deforming surfaces are straight and sloped relative to each other.
6. Deforming apparatus according to claim 3, wherein the first deforming surface is concave and the second deforming surface is convex.
7. Deforming apparatus according to claim 6, wherein the first and second deforming surfaces are curved.
8. Deforming apparatus according to claim 1, wherein the first deforming portion is fixedly mounted within the first member.
9. Deforming apparatus according to claim 8, wherein the first deforming portion is removably mounted within the first member.
10. Deforming apparatus according to claim 1, wherein the second deforming portion is fixedly provided within the second member.
11. Deforming apparatus according to claim 1, wherein the second deforming portion has a first deforming end and a second deforming end and at least one of the first and second deforming portions is planar between its first and second deforming ends.

12. Deforming apparatus according to claim 1, wherein the second deforming portion has a first end and a second end and at least one of the first and second deforming portions is concave between its first and second ends.
13. Deforming apparatus according to claim 1, wherein
the first member further comprises a first clamping portion;
the second member further comprises a second clamping portion;
the first and second members are movable relatively towards each other to the first relative position for clamping the deformable material member between the first and second clamping portions; and
the first and second members are movable relatively away from each other to the second relative position for releasing the deformable material member.
14. Deforming apparatus according to claim 13, wherein the first clamping portion is movable relative to the first member body and the first deforming portion between a first relative clamp position and a second relative clamp position.
15. Deforming apparatus according to claim 14, wherein
when the first and second members are in the first relative position and the first clamping portion, the first member body and the first deforming portion are in the first relative clamp position, the first clamping portion is closer to the second clamping portion than the first deforming portion is to the second deforming portion;
and
when the first and second members are in the first relative position and the first clamping portion, the first member body and the first deforming portion are in the second relative clamp position, the first clamping portion is further from the second clamping portion than the first deforming portion is from the second deforming portion.

16. Deforming apparatus according to claim 13, wherein the first and second clamping portions have first and second clamping surfaces, respectively, the first and second clamping surfaces being complementary to each other.
17. Deforming apparatus according to claim 16, wherein the first and second clamping surfaces are straight.
18. Deforming apparatus according to claim 16, wherein the first clamping surface is concave and the second clamping surface is convex.
19. Deforming apparatus according to claim 18, wherein the first and second clamping surfaces are curved.
20. Deforming apparatus according to claim 13, wherein the first clamping portion comprises a first clamping member resiliently mounted within the first member.
21. Deforming apparatus according to claim 20, wherein the first clamping member is mounted on one or more compression springs within the first member.
22. Deforming apparatus according to claim 13, wherein the second clamping portion is fixedly provided within the second member.
23. Deforming apparatus according to claim 13, wherein the first clamping portion and first deforming portion abut each other.
24. Deforming apparatus according to claim 13, wherein the second clamping portion and second deforming portion abut each other.
25. Deforming apparatus according to claim 13, wherein the second clamping portion and second deforming portion comprise portions of an integral clamp and anvil member.

26. Deforming apparatus according to claim 13, further comprising first guide means adjacent to at least one of the first and second clamping portions, protruding beyond that clamping portion in the direction of the other clamping portion.
27. Deforming apparatus according to claim 1, further comprising second guide means adjacent to at least one of the first and second deforming portions, protruding beyond that deforming portion in the direction of the other deforming portion.
28. Deforming apparatus according to claim 13, wherein the outer surface of the second clamping portion runs smoothly into the outer surface of the second deforming portion.
29. Deforming apparatus according to claim 1, further comprising a forwarding device for forwarding a deformable material member into between the first and second members, in a stepwise manner.
30. Deforming apparatus according to claim 1, wherein the deformable material member is a metal member.
31. Deforming apparatus according to claim 1, further comprising:
a third member comprising a third member body and a third deforming portion, the third deforming portion extending in a third direction and having a first deforming end and a second deforming end; and
a fourth member comprising a fourth member body and a fourth deforming portion; wherein
the third and fourth members are arranged to receive portions of the deformable material member between them in a fourth direction, transverse to the third direction, after the portions of the deformable material member have been deformed by the first and second deforming portions;

the third and fourth members are movable relatively towards each other to a third relative position to deform the deformable material member further, in the third direction, with the third and fourth deforming portions;

the third and fourth members are movable relatively away from each other to a fourth relative position; and

when the third and fourth members are in the third relative position, the first deforming end of the third deforming portion is closer to the fourth deforming portion than the second deforming end of the third deforming portion is to the fourth deforming portion.

32. A method of deforming a deformable material member having a width between two edges, the method comprising:

(a) positioning a first portion of the deformable material member in a deforming position between two deforming members;

(b) deforming the portion of the deformable material member at said deforming position across the width of the deformable material member;

(c) forwarding the portion of the deformable material member at said deforming position out from the deforming position, after the deforming; and

repeating the series of deforming and forwarding a plurality of times;

wherein during the deforming, one of the two edges of the deformable material member is compressed more than the other of the two edges of the deformable material member.

33. A method according to claim 32, wherein

(a) further comprises positioning a second portion of the deformable material member in a clamping position between two clamping members; and the method further comprises:

clamping the portion of the deformable material member at said clamping position before the deforming; and

unclamping the portion of the deformable material member at said clamping position after the deforming;

(c) further comprises forwarding the portion of the deformable material member at said clamping position to the deforming position, and a portion of the deformable material member adjacent to the portion of the deformable material member at said clamping position to the clamping position, after the unclamping; and the method further comprises

repeating the clamping and unclamping a plurality of times, such that the series of clamping, deforming, unclamping and forwarding is repeated a plurality of times

34. A method according to claim 32, wherein the difference in compression between the two edges of the deformable material member is linear across its width.

35. A method according to claim 32, wherein the difference in compression between the two edges of the deformable material member is non-linear across its width.

36. A method according to claim 32, wherein the deforming deforms the portion of the deformable material member at said deforming position into a fan shape.

37. A method according to claim 32, wherein the deformable material member is flat and extends in a first plane prior to deformation.

38. A method according to claim 37, wherein consecutive deformed portions of the deformable material member forwarded out from the deforming position form a curve in the deformable material member in at least the first plane.

39. A method according to claim 38, wherein consecutive deformed portions of the deformable material member forwarded out from the deforming position further form a curve in the deformable material member in a second plane orthogonal to the first plane.

40. A method according to claim 33, wherein the deforming occurs during the clamping.
41. A method according to claim 33, wherein the first and second portions of the deformable material member are distinct from each other.
42. A method according to claim 32, wherein the deformable material member is a metal member.
43. A method according to claim 32, further comprising:
positioning the deformed first portion of the deformable material member in a second deforming position between two further deforming members after the first portion has been forwarded from the first deforming position;
further deforming the first portion of the deformable material member at said second deforming position across the width of the deformable material member;
forwarding the further deformed first portion of the deformable material member at said second deforming position out from the second deforming position, after the further deforming; and
repeating the series of further deforming and forwarding the further deformed first portion a plurality of times;
wherein during the further deforming, one of the two edges of the deformable material member is compressed more than the other of the two edges of the deformable material member.